TEXTILE RESEARCH

Publication of

United States Institute for Textile Research, Inc.

CHARLES H. CLARK, *Managing Editor,*

Publication Office: Prince and Lemon Sts., Lancaster, Pa.

Editorial and General Offices: 65 Franklin St., Boston, Mass.

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Vol. VIII **March, 1938** **No. 5**

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Entered as second-class matter, November 17, 1932, at the Post Office at Lancaster, Pa., under the Act of Congress of March 3, 1879.

Issued monthly at Prince and Lemon Streets, Lancaster, Pa., for United States Institute for Textile Research, Inc., Boston, Mass.

Made in United States of America.

Subscription price $5.00 a year. Single copies .50.

The Editor's Page

A NOTABLE tribute to the late Hon. Francis P. Garvan is contributed to the February issue of *The Du Pont Magazine* by Dr. Charles H. Herty, nationally known research and industrial chemist, a past president of the American Chemical Society and of the Synthetic Organic Chemical Manufacturers Association, and for years a close friend of Mr. Garvan. The article, although brief, reveals Mr. Garvan's patriotic devotion to the development of the American chemical industry, and his zeal for an America self-contained industrially, politically and socially. It demonstrates anew that his biography when written and published will be an interesting and inspiring story of a great American. If you are not a regular reader of this magazine you should obtain this issue by addressing Editor, *The Du Pont Magazine*, Wilmington, Del.

* * *

DISTINGUISHED honor was accorded to Dr. Herty recently by governors, congressmen and industrial leaders of six of the Southeastern States, for his pioneering research work that has resulted in the establishment in those states of $100,000,000 worth of new kraft paper enterprises. Dr. Herty's research had for its objective the commercial use of southern slash pine for paper pulp. By his special sulphite process not only pulp for kraft and newsprint papers is now being produced in the Southeast, but a $6,000,000 mill is being built in Fernandina, Fla., to produce rayon pulp from slash pine, and at relatively low cost.

* * *

THE late Mr. Garvan is credited in Dr. Herty's tribute with having been a most important factor in the latter's slash pine research. "He alone," he writes, "could be led to give the initial financial aid for the realization through systematic research of a vision of the great pine forests of the Southeastern States becoming the source of America's cellulose, and he lived to see the solid foundations of an industry laid."

* * *

IF it had not been for the vision and the patriotic devotion to the development of American industrial independence, which motivated Mr. Garvan to provide Dr. Herty with the financial aid to start his research, it is possible that the latter, and not Mr. Garvan, might have been the second president of U. S. Institute for Textile Research, Inc. The related facts never have been made public, but because they are highly creditable to both men and provide a logical excuse for recording certain notable services of Dr. Herty to the textile industry, they will be briefly outlined. It is hoped, however, that they will not be interpreted as an effort by U. S. Institute to shine in the light of Dr. Herty's great research accomplishments.

FIRST, allow us to record some of Dr. Herty's prior services to the textile industry: It was because of his prominence in the chemical industry and its associations that his advice had been sought by the Textile Alliance, which allocated German reparations dyestuffs in this country following the World War. He also had an active part in the protracted struggle to secure adoption by Congress of the bill authorizing the Textile Foundation to take over and administer for textile research funds fortuitously accumulated by the Alliance. He gave freely of his advice to that Foundation in the development of its initial program in 1930, and U. S. Institute for Textile Research, which was organized in the Fall of that year, also profited by his advice. He had previously been a valued advisor to the Chemical Foundation. These activities had materially increased his acquaintance and enlarged his reputation in the textile industry.

* * *

ONE of the last official acts of Dr. Samuel W. Stratton, our first president, was to extend an invitation to Dr. Herty to be our guest speaker at the annual meeting in the Chemists' Club, New York City, Nov. 5, 1931. Dr. Herty's acceptance was received Oct. 17, the day before Dr. Stratton's sudden death. It is not strange that this combination of circumstances, plus Dr. Herty's outstanding reputation as a research authority, should have been accepted by our directors as almost miraculously indicating him as Dr. Stratton's successor. When first sounded out on the subject by mutual friends he seemed in a receptive mood. However, when Dr. E. H. Killheffer, who acted as toastmaster for the speaking program of the annual meeting, stated in introducing Dr. Herty that "the organization needs very greatly just the kind of counsel and leadership that Dr. Herty could give if he would or could," the latter was very definite in replying that while he was deeply affected by the confidence thus displayed in him and by the honor involved, his time was so completely occupied by his pine pulp research it would be impossible to assume additional activities, and that he could not consent to accept so important a position unless he could give it the time and thought it deserved.

* * *

SOMETHING seems to have occurred during the few days between his first sounding out on this subject and the date of his address. Perhaps it was on this visit to New York City from Savannah, Ga., where he was conducting his research, that Mr. Garvan assured him of the financial aid that was so sorely needed to carry forward initial research work. There seems to be circumstantial evidence of the correctness of this inference in the fact that Dr. Herty's declination of our presidency was accompanied by the suggestion that we try to prevail upon Mr. Garvan to accept it.

* * *

U. S. INSTITUTE FOR TEXTILE RESEARCH has been fortunate in having had the benefit of the leadership as its presidents of two of the country's greatest exponents of research: Dr. Stratton and Mr. Garvan. It has proved fortunate that fortuitous events prevented us from securing Dr. Herty as our second

president, and thus possibly diverting him from research efforts which have proved of such vast importance and benefit to the domestic cellulose industries; and not only to them, but also to the Southeastern States, in one of which, Georgia, he was born. The slash pine forests of those states have been converted by Dr. Herty's research into a new and practically inexhaustible source of cellulose pulp. To have been able to be of such outstanding service to his native South must be a great satisfaction to him.

* * *

U. S. INSTITUTE has three researches in progress, the report of one of which, a Survey of Production and Distribution Organization in the Textile Industries, is nearly ready for publication. Work on the textile drying study started last summer; that on warp sizing in the summer of 1935. In each instance there was a long period between the time the Research Council adopted the subject for study and the date when the initial research program was perfected and the financing completed. Whether the financing of a research is to be by a single company, or co-operatively by a group, convincing sales arguments must be presented. Dr. Herty faced the same initial difficulties in financing his research that U. S. Institute has. But Dr. Herty is a super-salesman of research, and had the ability to secure State as well as individual financial support that proved adequate. Furthermore, Dr. Herty had previously demonstrated his ability to produce research results having valuable applications. U. S. Institute still lacks the services of a super-salesman, and can point only to valuable indirect results of its research work. It is obliged as yet to offer co-operative research largely on a basis of faith in the possibility of its developing new basic knowledge that may have practical application. Probably Dr. Herty could have guaranteed nothing more at the start of his great research.

* * *

ALTHOUGH U. S. Institute has no one research in progress the results of which give promise of proving of as great value to the textile industry as do the results of Dr. Herty's research to the pulp and paper industries, there is some encouragement to our members in the fact that his work and commercial application of its results extended over a period of approximately the same length as the life to date of U. S. Institute. This leaves us from five to seven years in which to produce valuable results if measured by the same yardstick. The time might be shortened materially if we could have financial support more nearly equal to that secured by Dr. Herty. Appropriate in this connection is the quotation from Mr. Lammot du Pont that was published on the front cover of this magazine last month. It justifies repetition: "Rarely is research successful except through patient, sustained work over a period of years, during which substantial sums must be expended long in advance of any hope of return."

* * *

Twist Measurements in Single Yarns

By E. R. SCHWARZ, F.T.I.*

WITH the possible exception of the fibres used in its formation, the twist in a yarn is probably its most important physical characteristic. Even in the continuous filament rayon yarns, twist (although present normally in only small degree) is important to keep the filaments together. In crêpe yarns of any sort the twist is high and is a vitally important factor. For yarns composed of short fibres, such as cotton, twist is necessary to give the strand any strength at all.

While we are accustomed to express twist in terms of turns o. twist per inch, many textile men fail to appreciate that there are, in general, three distinct things which must be measured in order to obtain it. These are the total number of turns, the length in which the turns are measured, and the direction of the twist. Thus specifications adopted by various bodies usually specify the tension under which the length of the yarn shall be measured, and usually define the directions of twist. There has not been entire agreement as to the proper definition of either.

Simplifying the Simple

Examples may be noted in illustration of this contention. For instance, it has been only very recently that "S" twist and "Z" twist have been substituted for the earlier "Left" and "Right" respectively. While the present convention may be a blessing to those who cannot distinguish their right hands from their left (or for those who never let the right hand know what the left hand does) it has little merit except as a compromise.

The objection (frequently voiced) to the definition of right twist yarn as that in which the helices run up to the right as one looks along the yarn is that in fine yarns it is difficult to see the direction taken by the helices, or even to see the helices at all. There would seem to be no good reason, however, why a hand magnifying glass or a microscope might not be employed, or in any case why the yarn might not be partly untwisted between the fingers, when the helices will become readily visible. Since it is further necessary to see the helix direction in order to determine whether or not it conforms to the direction of the middle portion of the capital letter "S" or "Z" respectively, the newer system would seem to have no advantage in this respect. It must be pointed out, of course, that only capital letters and only printed characters are allowable. If script letters are used the method falls dismally by the wayside. The terms "Right" and "Left" conform to the widely accepted conventions for right and left threads used in instrument and machine design and recognized everywhere by scientists and engineers. While the S twist and Z twist apparently settled an argument, they seem to be very much of a sop thrown to the thereby admittedly unscientific textile manufacturer. But however the direction of twist may be

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designated, it is important and must be recorded in any analysis claimed to be at all complete.

Measurements Based on Helix Angle

The attention drawn to the helical structure of yarns serves another useful purpose, for it makes the yarn spinner, user and analyzer aware of twist angle. This is a most useful concept, as we shall see. Doubly so, since it can be easily demonstrated that contraction due to twist is measurable directly in terms of the twist angle in such a way as to be independent entirely of the yarn diameter. The required measurement can be made on a yarn which is entirely untensioned or subjected to any desired tention.

The relationship takes the form: % Contraction $= 100\ (1 - \cos.\ Q)$ where Q is the helix angle.

Whether for the purpose of measurement of contraction due to twist or for the purpose of measuring twist itself, the proper tension is that which will straighten the yarn without stretching it. This must ordinarily be determined by experiment for each type or construction of yarn tested. The use of an arbitrary formula as advocated in certain specifications, *viz.*,

Tension in grams $= \frac{156}{\text{yarn counts}}$,* or $\frac{131}{\text{Typp counts}}$ is not believed to be justified for plied yarn—much less for singles. The constant of the formula was obtained as the result of certain tests carried out a number of years ago on the 11-ply 23s yarn used in the manufacture of square woven tire fabric.[1] As a result, a proper tension of 75 grams was obtained. The writer has already demonstrated in this journal[2] that the error resulting from the use of this formula on randomly selected cotton yarn amounted to as much as 1100%.

TABLE I

Grams to straighten but not stretch

Yarn Counts (Single or Equivalent single)	A. S. T. M. Method	Actual Test	% Error
1.4	111.5	9.1	+1100
2.1	75.0	75.0	0
3.8	40.7	4.2	+ 870
4.0	38.8	5.5	+ 600
10.3	15.4	5.8	+ 165
41.4	3.8	5.6	− 30

If the relationship noted is so far wrong for cotton, it must certainly be expected to be impossible for yarns of other fibres which will have markedly different stretch characteristics. It will also be wrong for single yarns, the stretch characteristics of which differ from those of plied yarns. The error introduced into the computation of twist per inch expressed in per cent will equal the per cent error made in the length measurement by variation in the tension used. So long as the tension is kept down to a small fraction of the breaking strength, the error is not likely to be large. For precise work,

* Cotton system.

however, every effort should be made to determine the proper tension to employ.

In twist testing, as in other textile testing, the problem of sampling is receiving increasing attention. Thus the decision as to the proper length of sample is important. The shorter the length chosen, the greater the number of tests needed to obtain a reliable average.

TABLE II

Method of Test	No. of Tests	Twist per Inch
One inch gauge length	25	29 ± 2
One-half inch gauge length	25	31 ± 3
$\frac{N_2 - N_1}{2L}$ (Tension jaw locked)	25	32 ± 2
$\frac{N_2 - N_1}{2L}$ (Tension jaw free)	25	31 ± 2
Pendulum with critical condenser capacity	10	28 ± 2

Hence a number of attempts have been made to test lengths of single yarn greater than one inch. Difficulty is almost invariably encountered where relatively short fibred materials are concerned. Presence of tangled fibres, non-parallel fibres, and slippage of fibres contribute to the virtual impossibility of determining when all the twist has been removed.

Long vs. Short Lengths in Twist Testing

In one design of twist tester provision is made to progressively remove turns of twist from short lengths successively along the yarn, beginning at the rotating jaw, and using a system of moveable clamps.[3] The technique is somewhat difficult and time consuming, particularly as it is recognized by most workers with yarn that, even with short gauge lengths, it is difficult to remove all the turns with assurance.

With the trouble involved in the usual methods of measurement in mind, it is interesting to note that several techniques have been developed with the possibility of long gauge lengths being employed. One such involves the principle of twisting up a yarn until it breaks under a known tension.[4, 5] The turns required to do this are recorded as N_1. A second specimen of yarn is then placed under the same tension and at the same gauge length and untwisted and retwisted until it likewise breaks, the direction of rotation of the revolving jaw of the twist tester being continuously in the opposite direction to that employed for the first specimen. The total turns required to break the yarn are recorded as N_2. If now we compute $N_2 - N_1$ and divide this result by twice the gauge length used, we have the twist per inch. The assumption made is that the breaking twist for constant tension is the same for both specimens of yarn, and this can be shown to be in error. Assumption is also made that retwisting the yarn in the opposite direction to a known tension requires the same number of turns as to untwist the yarn completely. The derivation of the formula is as follows:

Let N_1 and N_2 be defined as above.
Let L be the gauge length in inches.
Let n be the total turns originally in the yarn.

In the second part of the operation "n" turns are first removed and reinserted in the opposite direction, together with N_1 turns to break the yarn, thus we can write

$$N_2 = 2n + N_1$$

But "n" is the twist we want to find, thus

$$n = \frac{N_2 - N_1}{2}$$

and the twist per inch will be

$$T = \left(\frac{n}{L}\right) = \left(\frac{N_2 - N_1}{2L}\right)$$

Statistically, the errors introduced by variation from the assumptions made may be minimized by using a large number of observations and reporting the average. In any case the results frequently are not significantly different from those obtained by more usual methods. Thus the data of Table II gives the twist per inch for a randomly selected yarn tested by five different techniques. Closest agreement is found between the M. I. T. pendulum method (to be described) and the usual test of a one-inch gauge length. It should be noted, however, that the precision (as indicated by the standard deviation of the mean) is approximately the same, although less than half as many tests were made by the pendulum method.

While the differences found in this tabulation in any case are not significant, it is further interesting to see that the precision is higher for the tests by the one-inch gauge length method, than for the ½ inch gauge length method—when the same number of tests was used in each case.

The Tension Problem in Untwist-Retwist Measurements

It is believed further than an improvement in the "untwist-retwist" type of technique consists in establishing a known and small tension at the start of the test, and untwisting and retwisting the specimen until that initial tension is exactly reestablished. The problem is complicated by the difficulty of determining when this condition has been brought about, but at least a definite tension is reached, rather than a variable breaking strength of the material under test.

The A. S. T. M. Standards on Textile Materials (D180–37) read as follows for single cotton yarns and threads:

> "The turns per inch of twist in single yarn or thread shall be determined on any standard single yarn twist tester employing the principle of first taking the twist out of a given length of yarn and then retwisting in the opposite direction until the same amount of twist is put back, dividing the results by twice the distance between grips to obtain the twists per inch. The minimum distance between jaws shall be 5 in., but a 10-in. distance is preferable. In making this test, it is essential that check tests be made before proceeding with regular tests in order to determine the proper tension to be placed on the yarn or thread so as not to cause slippage of fibre or other variations."

The necessary small tension is almost universally applied by means of a pendulum. The differences between methods so far reported lie in the direction of swing of the pendulum relative to the axis of the yarn, and in the methods of determining the end point.

The statement just quoted is believed to be somewhat naive if taken at its face value, for obviously if the amount of twist to be put back is known, *this is itself the desired number of turns* to give the twist per inch. There would, therefore, be no necessity for making the test. What is meant is that some means (such as a pendulum) must be employed to fix the end point of the test. This end point is thus assumed to come when the original tension has been restored after re-twisting.

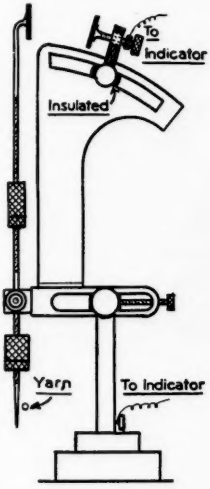

FIG. 1. A critical capacitance determines the end-point of the swing of this pendulum for single yarn twist testing.

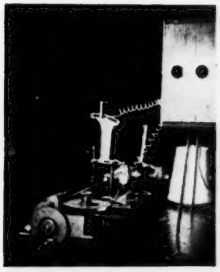

FIG. 3. Pendulum and signal system in place on Suter twist tester arranged for the measurement of twist in single yarns.

If the pendulum swings in a plane containing the yarn axis, it is usually employed to exert not only the tension which is to be restored but also the tension necessary to establish the correct gauge length. This tension is ordinarily too high for sensitive test by the pendulum method. It is further not particularly easy to establish both tension and gauge length, since each depends upon the position of the pendulum. Frequently the tension can be set, but at an inconvenient or indeterminate gauge. Conversely, if the gauge is properly established, the tension produced by the pendulum will be incorrect. Thus devices which employ a pendulum swinging in a plane (usually the vertical plane) of the yarn axis are to be avoided. The difficulty of setting both tension and gauge length with such a device is much greater than is the case with a pendulum which swings in

a plane at right angles with the yarn axis. In this latter instance whether the pendulum is essentially horizontal or vertical is a matter of minor importance. More important is the method by which restoration of the tension is indicated.

In some cases a pointer is read against a scale. Since it ordinarily takes a rather large number of turns to produce a small motion of the pointer along such a scale the precision of such a device is open to question. Attempts have been made to make the pendulum a part of an open electric circuit. The circuit is closed by means of a metal-to-metal contact when the tension reaches its proper magnitude. Difficulty is experienced in keeping the contact surfaces free from dirt and pitting, and there is always the possibility of having to exert a variable pressure between the contact surfaces in order to produce a satisfactory signal in the form of a light or bell. Such pressure is included in the yarn tension, and is therefore undesirable.

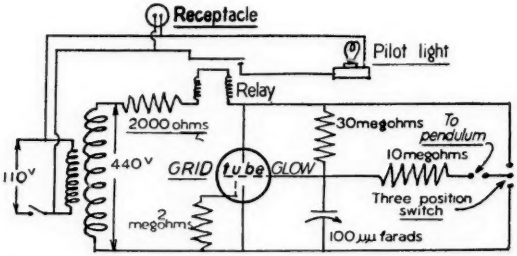

FIG. 2. Wiring diagram for grid-glow tube circuit. Used with the M. I. T. single twist pendulum.

In a device which was designed for general laboratory use for the establishment of a signalling or recording system independent of pressure or metallic contacts, the capacitance of a condenser is employed to actuate a relay circuit, which in turn operates any 110 volt device desired. One plate of the condenser is attached to the pendulum and oscillates with it. The other is adjustable, but, once adjusted, remains fixed in position for the test. A sensitive grid-glow tube makes the device instantly responsive. So sensitive is it, that if the operator merely touches the pendulum, the signal will be actuated. The natural body capacitance is sufficient to trip the relay. Thus, when the distance between the two condenser plates is re-established, a critical capacitance is reached which causes the instrument to signal or to record the observation. The relative humidity of the air in the test room makes no difference so long as it is reasonably constant throughout the test. Since for precise control of tension a standard and uniform condition of atmospheric humidity and temperature is very desirable from the standpoint of the physical properties of the yarn, the requirement of constant conditions for the signal system introduces no new hardship.

Fibre Slippage Errors in Retwisting

Returning to consideration of the A. S. T. M. method already quoted, the determination of a tension which will not cause slippage of fibres initially may be fairly easily worked out. But slippage of fibre, or at least readjustment of fibre position as a result of retwisting, will normally occur.

Reference to Table III indicates what may happen at very low pendulum tensions when the process of twisting and retwisting is repeated several times on the same specimen. In only three cases out of ten, was it found that the dial registering total turns was at zero when a sample was untwisted, re-twisted, and untwisted again to the original tension. The average departure from zero was an over-run of 5.5 turns, indicating some slippage or rearrangement of fibres in the yarn. If the procedure is repeated, this effect becomes more and more pronounced, reaching a value of 47 turns at the end of the third cycle. While the error during the actual measurement of twist by this method is probably less than 1%, and hence may be neglected, it is present and in special cases might be found to be appreciable. Such an instance might be a soft twisted cotton knitting yarn.

TABLE III

Dial Reading

Sample	Untwist, Retwist	Untwist	Untwist, Retwist	Untwist	Untwist, Retwist	Untwist
1	250	− 5	289	−31	323	−59
2	266	− 8	305	−31	341	−52
3	321	−10	362	−20	391	−42
4	298	− 7	313	−15	382	−38
5	285	0	319	−18	377	−36
6	305	0	346	−28	370	−43
7	281	−10	328	−31	355	−60
8	248	0	283	−26	328	−50
9	268	− 7	316	−24	345	−55
10	292	− 8	314	−20	360	−54
Av.	278	− 5.5	317	−26	350	−47

(5-in. gauge length)

Change in Twist Due to Unwinding

For rayon yarns, tensions varying from 10 grams (for yarns less than 75 denier) to 30 grams (for yarns over 150 denier) are recommended by the A. S. T. M., while for woolen and worsted singles just sufficient tension to prevent sagging of a 4-in. gauge length is designated as proper. In none of these latter instances is the "untwist-retwist" technique specified, although no alternative is suggested for rayon. Simple untwisting of the yarn to parallel fibres is designated for woolen and worsted yarns. Further clarification of technique seems desirable to reach a more nearly consistent method for single yarns.

Certain specifications of test methods for twist determination require that the yarn for test be unwound from the side of the package, rather than over either end.

Work done by Woods [6] demonstrates mathematically the change in twist per wrapping helix for various conditions of winding and subsequent unwinding. The usual concept of one turn of twist added or subtracted from the twist present in each wrapping helix per helix is modified by use of the factor $(1 - \cos. Q)$, where Q is the helix angle of wrap measured between the axis of the yarn and the axis of the package.

One turn variation will be approached closely only for large values of Q and the resultant change would ordinarily be worth consideration only for yarns of low twist, and possibly for yarns wound on small diameter packages.

If we consider a 25[s] cotton yarn, with 15 twists per inch, wound on a cop or quill ½-in. diameter in close helices ($Q = $ approx. 90°), we would have $(1 - \cos. 90°) = 1$ turn change out of $(3.14/2)\ (15.0) = 23.6$ turns, or an error of 4.2%.

In the case of a 150 denier rayon yarn wound on the usual spool, the error would be about 5% if the sample was removed from a full spool, or about 10% if taken from a nearly empty spool. Thus the A. S. T. M. specifies unwinding from the side of the package for rayon.

Question may well arise as to the error due to unwinding over the end of a cone of rayon yarn—which is the usual procedure. If a half-full cone of rayon is examined in this respect an error of as much as 3% may normally be found, since the helix angle is approximately 80° and the length of one helix is about 10 inches.

As a further matter of precision, attention should be paid to the fact that if the total turns are to be recorded for a 10 in. gauge length to the nearest turn, this will ordinarily mean measuring the length to within one half of one per cent, or to the nearest .05 inch. This is quite possible. On the other hand, if the turns are recorded to the nearest tenth of a turn (as is sometimes possible with certain twist testers), the length must then be correct to the nearest .005 inch, which is not possible. Because of difficulties inherent to the extremely precise measurement of yarn length in twist testing, it is seldom, if ever, necessary to read the dial of the tester to less than the nearest whole turn.

It must always be remembered that three things must be measured when twist tests are made on yarns, and that they are substantially equal in importance. They are twist direction, total turns and gauge length. Proper sampling, proper technique and proper interpretation of the data are likewise essential. It is important that yarns be twisted. It is tragic if the investigator is twisted too!

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Breaking Strength of Dress Fabrics: Relation of Strip to Grab Test Results

By HARRY A. MERENESS *

Abstract

Formulae are given for the strip-grab relations for some usual textile dress fabrics. The formulae were determined from graphs made by plotting several hundred breaking strength tests. Limits of correlation agreements are given.

Introduction

THE writer has recently had occasion to collect for comparative purposes a considerable amount of data on the physical characteristics of various silk, rayon, wool and cotton dress fabrics. In many cases it was found that the test results for breaking strengths could not be used due to the fact that some of the breaking strengths were given as done by the strip method, while other data were based on the grab test. This led the writer to attempt a correlation between strip and grab test data.

With one exception the fabrics studied were dress materials. All tests were made according to the official test methods of the American Society for Testing Materials, or Federal Specification CCC–T–191.

It should be noted that the formulae derived are given subject to their relative accuracy as noted.

Formulae

	Warp	Filling
Silk Dress Materials	$S = 0.8\,G$ $G = 1.25\,S$	$S = 0.75\,G$ $G = 1.33\,S$
Rayon Dress Materials	$S = G - 12$ lbs. $G = S + 12$ lbs.	$S = G - 12$ lbs. $G = S + 12$ lbs.
Spun Rayon Dress Materials	$S = G - 9$ lbs. $G = S + 9$ lbs.	$S = G - 14$ lbs. $G = S + 14$ lbs.
Cotton Dress Materials	$S = 0.83\,G + 4.4$ lbs. $G = 1.2\,S - 5.3$ lbs.	$S = 0.83\,G + 1.8$ lbs. $G = 1.2\,S - 2.2$ lbs.
Cotton Shirting and Sheeting	$S = 0.9\,G - 1$ lb. $G = 1.1\,S + 1.1$ lbs.	$S = 0.75\,G + 3.0$ lbs. $G = 1.33\,S - 4.0$ lbs.
Woolen Dress Materials (a)	$S = 0.75\,G - 2.5$ lbs. $G = 1.33\,S + 3.3$ lbs.	$S = 0.75\,G - 2.5$ lbs. $G = 1.33\,S + 3.3$ lbs.
(b)	$S = 0.7\,G$ $G = 1.42\,S$	

Notes

S = breaking strength (lbs.), strip method
G = breaking strength (lbs.), grab method

No flannels or gabardines included in fabrics used for deriving formulae under (a), Woolen Dress Materials. Fabrics were mostly crêpes and novelties. Formulae under (b) are entirely from flannels, serges and gabardines; see text under "Discussion."

* Director of Technical Research, National Federation of Textiles.

Limits of Correlation Agreements

Silk Dress Materials: The formulae appear to be precise to within ± 4.0 lbs. for crêpe backed satins, flat crêpes, canton crêpes and georgettes. Not precise for taffetas. About 30% of the figures were not comparable.

Rayon Dress Materials: Formulae appear to be precise to within ± 3.0 lbs. for regular and spun rayon fabrics. About 20% of the results were found to lack comparability.

Cotton Dress Materials: Checked within ± 2 lbs. with only one result out of 12 outside the limits.

Cotton Shirting and Sheeting: Checked within ± 3 lbs. with about 16% of the results outside the limits.

Woolen Dress Materials: For formulae under (a) the figures checked within ± 3 lbs. Not precise for 15% of the fabrics studied. For formulae under (b), the equations for warps were rather reliable, but the equations for the fillings of flannels, serges and gabardines were not considered valid (see text).

Discussion

The equations which precede were derived from graphs, the number of points plotted for each material varying from 25 to 120.

A study of the equations shows that they generally represent straight lines, passing mostly through or near the point of origin, with slopes varying from Tan $\alpha = 1.0$ to Tan $\alpha = 1.5$. The only line outside these limits is that represented by the equation $S = 0.3\ G + 7.3$ lbs., which is for the filling of flannel cloths.

The formulae derived for the fillings of flannels, serges and gabardines are as follows:

(b) Flannels	
$S = 0.3\ G + 7.3$ lbs.	$G = 3.33\ S - 24.3$ lbs.
(b) Serges	
$S = 0.6\ G + 3.0$ lbs.	$G = 1.66\ S - 5.0$ lbs.
(b) Gabardines	
$S = 0.5\ G + 7.4$ lbs.	$G = 2.0\ S - 14.8$ lbs.

Unlike any of the other fabrics studied, the points plotted for these woolen fabrics did not give satisfactory equations. Not only do many points on the graph fall outside the limits for normal plots on a straight line, but the points generally lie in a restricted region between 13 and 25 lbs. strip and 16 to 28 lbs. grab. It is evident from simple inspection of these equations that their use might lead to large errors.

Relation of These to Previously Published Results

Work done in 1916 by W. S. Lewis[1] was confined principally to muslins and sheetings in cotton fabrics, and kerseys and meltons in woolen fabrics. Warp and filling results were generally not given separately. Lewis obtained grab results almost double those for strip tests, and his grab results for cotton fabrics were relatively considerably higher than the corresponding figures given in the present report.

Professor Haven[2] gives some figures on pp. 413–415 in his book "Mechanical Fabrics." Here again the fabrics studied were not dress mate-

rials, but principally heavy cotton fabrics, and the portion of the curve for fabrics weighing less than 4 ozs. per square yard is too small to offer a basis for comparison with the data furnished here.

A report by H. F. Schiefer and D. H. Taft[3] on the relation of yarn twist to breaking strength and elongation of cotton fabrics offers considerable data on the strip-grab relation of one series of cotton fabrics in which the only variation was the twist of the yarns. Their plotted points lie in a region slightly above the line Tan $\alpha = 1.0$. The general equation is $S = G - 4$ lbs. ($G = S + 4$ lbs.). This formula agrees quite closely with our formula for cotton dress materials and departs only slightly from that for cotton sheeting warps.

Conclusions and Suggestions

Woolen fabrics in general seem to offer more complex relations than either cotton, rayon or silk. This holds particularly true for fabrics which have been felted.

Some apparent anomalies are afforded. For instance, it was observed that while light weight twills and square weave cotton fabrics were found to agree quite well, silk taffeta, a simple square weave, generally gave results which were not comparable with other silk fabrics.

Some of the questions raised by these data are:

What percentage of the variations found were due to the actual fabrics and what to the testing procedure?

What exactly is the effect of different weaves on the strip-grab relation?

What effect does finishing have, and especially, what is the effect of felting?

Finally, the large percentage (from 8% to 30%) of the results falling outside the limits of reasonable agreement raises the question of the general validity of the formulae, and shows the need for an extended scientific study of the whole subject under rigorously controlled conditions.

Acknowledgments are gratefully made to Miss Hays of the Bureau of Home Economics, U. S. Department of Agriculture, to Miss Phelps, University of Minnesota, and to Miss Worner, National Bureau of Standards, for the data from which the formulae were derived.

References

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2. "Mechanical Fabrics." G. B. Haven. Chap. VIII, pp. 413–15. John Wiley & Sons, New York, N. Y.

3. "Effect of Yarn Twist on the Properties of Cloth." H. F. Schiefer and Daniel H. Taft. *B. S. J. Rsch.*, Feb. 1936, P. 131–38; RP 861.

Abstracts

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I. Fibres (Synthetic and Natural) and Fibre Analysis

Absorption of Water by Cellulose and Cellulose Compounds. J. Tankard. *J. T. I.*, Sept. 1937, P. T263–T292.

The various theories which have been advanced to explain the phenomena associated with the absorption of water by cellulose and cellulose compounds are reviewed and some reference is made to the experimental work upon which these theories are based. The method of Champetier for the determination of water of hydration is discussed in detail and his method has been applied to the study of the absorption of water by cellulose and a number of cellulose compounds.

It is suggested that the results of these experiments do not indicate that cellulose and its compounds form a limited number of definite hydrates, but that there is, for each of the substances examined, a maximum amount of water which can be regarded as entering into chemical combination.

This maximum value corresponds to 0.5 molecule H_2O per molecule $C_6H_{10}O_5$ in the case of bleached cotton and linen cellulose; 0.75 molecule H_2O per molecule $C_6H_{10}O_5$ for mercerized cotton which has been dried subsequent to mercerization; and 1.0 molecule H_2O per molecule $C_6H_{10}O_5$ for mercerized cotton cellulose which has not been dried after mercerization, for mercerized linen cellulose whether dried or not after mercerization, and for regenerated (viscose) cellulose. The results obtained with cellulose acetate suggest a value of 3.0 molecules H_2O per hexose unit for cellulose tri-acetate, and a similar value is obtained with cellulose mono-methylene ether. (C)

CELLULOSE DERIVATIVE SOLS: ELECTRO-KINETIC PHENOMENA AT INTERFACES. K. Kanamaru and T. Kohno. *Kolloid Z.*, 1937, V. 79, P. 190–208; also *J. Soc. Chem. Ind. Japan*, 1937, V. 40, P. 102–10, 128–37; abs. in *J. T. I.*, Sept. 1937, P. A522. (C)

CELLULOSE ESTER PLASTICS. V. E. Yarsley. *Chem. & Ind.*, June 26, 1937, P. 591–3; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

A survey was made of the sources of the raw materials for cellulose nitrate and acetate, and the possibilities of obtaining new sources in Great Britain in the event of war. A new quick-growing source of cellulose would have to be found to replace cotton linters. Flax, hemp, jute, etc., are possible substitutes. Possible war demands on the industry are noted, and it is pointed out that British-made film base is now available. (S)

CELLULOSE MICELLES: INDIVIDUAL. O. Kratky and H. Mark. *Z. physikal. Chem.*, 1937, V. 36B, No. 2, P. 129–39; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

A theoretical discussion is given on the possible existence of individual or non-individual micelles. No new experimental data are presented but the case for individual micelles is argued on the basis of X-ray and other evidence previously presented. (S)

CHEMICAL STUDIES ON SILK FIBROIN. IV. CHEMICAL RELATION AMONG FIBROIN COMPONENTS. H. Kaneko. *J. Agr. Chem. Soc. Japan*, 1937, V. 13, P. 208–15. V. VISCOSITY OF FIBROIN COMPONENT SOLUTIONS. Kaneko, Komatsu and Nakazawa. Ibid., P. 217–24; abs. in *C. A.*, 1937, V. 31, Col. 2827, 7657. (W)

FIBROIN: CHANGE OF LATTICE CONSTANTS OF—BY PERFECT DRYING. Y. Matsunaga. *Mem. Coll. Sci., Kyoto Imp. Univ.*, 1937, V. A20, P. 157–71; abs. in *C. A.*, 1937, V. 31, Col. 262, 8932.

A vacuum camera such as that used by Takei (*C. A.*, *27*, 3105) was used to det. the lattice consts. of silk (*Bombyx mori*), wild silk (*Altheraea pernyi* and *Antheraca yamamay*), ramie and rayon (viscose, Bemberg and nitrocellulose) in the perfectly dry state and in the wet state by means of X-rays. The densities of the specimens were measured in primary normal alcs. and in H_2O by the evacuation method of Yoshida and Takei (*C. A.*, *26*, 3916). The lattice const. of perfectly dry silk fibroin is less than that of wet fibroin. The fibroin therefore undergoes intramicellar swelling by absorbing water. Eight mols. of H_2O penetrates into the unit cell of dried fibroin and this change is reversible. Even with the evacuation method, the d. measurement by dipping a fibrous substance into a liquid is not perfect because of the presence of very narrow intermicellar spaces into which the liquid cannot penetrate. The width of the intermicellar spaces of different fibres such as ramie, silk fibroin and viscose is not uniform. In silk fibroin it varies from 0 to 10 Au. The contraction of a photographic film due to evacuation was measured by comparing the distances between 2 pin holes in the film. It was 0.84–94%, much smaller than the displacement of the diffraction spots by perfect drying of fibroin and ramie. The absence of displacement of the different spots by perfect drying with rayon fibres seems to confirm the view that the displacement of the diffraction spots caused by

perfect drying, as was detected with fibroin and ramie, is due to changes in the size of the unit cell of the crystals. (W)

Identification of Crystalline Cellulose in Young Cotton Fibres by X-ray Diffraction Analysis. Wayne A. Sisson. *Contrib. Boyce Thompson Institute,* 1937, V. 8, No. 5, P. 389–400.

1. Cotton fibres ranging in age from 5 to 50 days were subjected to X-ray diffraction analysis. The samples consisted of both fresh and preserved fibres in the untreated condition; after extraction with chloroform; and after further purification with 1% sodium hydroxide and 2% sodium hypochlorite.

2. X-ray analysis showed the presence of crystalline cellulose at approximately 30 to 35 days in the untreated fibres; between 15 to 20 days after extraction; and as early as 5 days in the purified fibres.

3. The cellulose pattern is not present in the X-ray diagram of the untreated fibres because it is masked by a crystalline "wax pattern," which may be removed by extraction with organic solvents, and by an amorphous diagram, which is removed by treatment with dilute alkalies and bleaching.

4. The crystallographic identity of the cellulose obtained from the young purified fibres to that of mature cellulose is shown, not only by its identical unit cell dimensions, but also by the fact that the native X-ray pattern may be changed to a mercerized pattern.

5. The present data corroborate the observations of Farr and Eckerson that cellulose is first formed in the cytoplasm as crystalline cellulose particles. Cellulose, after it is once formed, does not undergo a crystalline modification during fibre growth. (C)

Internal Pore Structure of Silk. Thomas Lonsdale. *Silk J. Rayon World,* 1937, V. 14, No. 158, P. 20; abs. in *C. A.*, 1937, V. 31, Col. 7255; *J. T. I.*, Oct. 1937, P. A574.

As interpreted from X-ray studies, the chain mol. structures of silk and stretched wool are postulated and shown, illustrating great similarity between them. The dissimilarity is that on certain C atoms of the silk structure, the attached H atom is replaced by an org. radical group in the stretched wool. The microscope does not disclose pores, but they are deduced from (a) moisture regain and swelling data and (b) inference from the known pore structure of wool and the similarity in the mol. structure above stated. (W)

Micellar Structure of Fibre Substances. O. Kratky. *Silk and Rayon,* 1937, V. 11, P. 714, 716, 718, 720; abs. in *C. A.*, 1937, V. 31, Col. 8932.

A concept of micellar structure and swelling of fibre substances is given. The mech. and optical behavior of cellulose films is in good agreement with this concept. (W)

Microscopic Textile Pictures. I. Böhme Fettchemie-Gesellschaft m. b. H. *Klepzig's Textil-Z.*, 1937, V. 40, P. 509–15; abs. in *C. A.*, 1937, V. 31, Col. 7654.

Thirty photomicrographs at a uniform enlargement of 540 are given for various kinds of wool and hair, cottons, asbestos in aq. glycerol, linens, ramie fibres and rayons. (W)

II. Yarns and Fabrics

Mildew on Cotton Goods: Some Common Antiseptics for Prevention of. Walter Bruckhaus. *Appretur-Ztg.*, 1936, V. 28, P. 35–7; *Chem. Zentr.*, 1936, V. II, P. 216; abs. in *C. A.*, 1937, V. 31, Col. 8205.

Both inorg. and org. antiseptics are considered. (W)

Off-weight Drawings. E. H. Helliwell. *Tex. Wld.*, Jan. 1938, P. 54–5.

Their avoidance by simple method for determining required cotton-sliver size at any regain. (C)

Preservation of Textiles for the Fishing Trade. J. W. Durant. *Dyer*, 1937, V. 77, P. 335–37, 389–90, 441–42; abs. in *J. T. I.*, Aug. 1937, P. A443.

The manufacture of fishing nets is described. Scotch nets are tanned with catechu (cutch) and then chromed, and Dutch nets are treated with linseed oil. Other substances used are copper oleate, an emulsion of oleate and creosote, creosote alone or a mixture of creosote and Stockholm tar. For use in fresh water, mixtures of cuprous oxide with various tars are recommended. Mention is made of Cross and Dorée's investigations on esterification as a method for immunizing against bacterial attack. (C)

Rayon Manufacture. H. DeW. Smith. *Tex. Wld.*, Sept. 1937, P. 104.

New manufacturing methods, new products and trends, with production of strong yarns for mechanical uses the outstanding technical development. (C)

Rayon Crêpe Research. IV. An Investigation of the Manufacture of Uniform Rayon Crêpe Dress Fabrics. W. F. Macia. *Am. Dye. Rptr.*, Jan. 10, 1938, P. 17–22.

Five hundred yards of rayon crêpe fabric were made on some of the best commercial equipment and by representative commercial methods to determine (1) whether it was possible to make fabrics which were free from variations in pebble from regular deliveries of warp and filling yarns, and (2) to predetermine the quality and uniformity of finished fabric which could be obtained from the rayon yarns and methods of processing which were to be used subsequently in this research. This investigation showed that it is possible to make rayon crêpe dress fabrics free from objectionable variations in pebble, using yarn having the physical properties which tests showed were within the range found in ordinary commercial deliveries. (See Part No. 6 in this report for test results.) It also showed that uniform fabrics could be made from the yarns provided for this research when processed by the methods adopted. (C)

Rayon Size: New. E. I. du Pont de Nemours & Co. *Rayon Tex. Mo.*, Dec. 1937, P. 47.

The water-soluble synthetic product, designed especially for sizing viscose and acetate warps, and the filling yarns of crêpe fabrics, the product of E. I. du Pont de Nemours & Co., is described. It is known as Rayon Size MW. Some of its properties and advantages that are noted are as follows: Being a purely synthetic material, built up by chemical reactions

from simple chemical compounds of definite melting and boiling points it is uniform and reproducible from batch to batch; is indefinitely stable; viscosity of solutions is unaffected by heating and stirring; is effective at low concentrations—1% or less for viscose and 2–4% for acetate warps; requires no softener for most purposes. (C)

RUBBERIZED FABRICS: CAUSES OF FAULTS IN. *Bull. Lab. Anal. et Rech. Ind., Roubaix,* 1937, No. 35, P. 9–18; abs. in *J. T. I.,* Nov. 1937, P. A624.

Bluish bars across the face of a white cotton fabric with a rubber-coated back were found to be due to contact with the cross-bars in the vulcanizing oven and the yellowing of white rubberized cotton and rayon fabrics on storing was traced to oxidation of hydrocellulose which was present in the fabric before treatment with rubber, the oxidation being catalyzed by traces of ammonia from the neutralization treatment following vulcanization. Details of the methods of investigation are given. A study of the effect of rubberizing on the fastness to rubbing of dark blue dyed fabric is described. Samples of the dyed fabric before and after treatment with rubber were caused to rub to and fro on bands of white fabric and the color transferred to the latter was analyzed by means of a photo-colorimeter. A suitable rubbing device is briefly described. The results show that the rubberizing treatment does not have any unfavorable effect on fastness to rubbing. (C)

RAISED WARP GOODS FROM RAYON. Arthur Schöffler. *Klepzig's Textil-Z.,* 1937, V. 40, P. 530; abs. in *C. A.,* 1937, V. 31, Col. 8205.

Any unsatisfactory appearance of raised warp goods from rayon is not necessarily due to faulty finishing operations but may be caused by working together different rayons of unequal single thread no. Thus Cu rayon should never be used together with coarse threads of acetate rayon. The brittle, coarse threads of acetate rayon are completely destroyed during raising long before the soft, pliant Cu rayon is attacked. If the treatment is not carried out sufficiently far then only the strips contg. acetate rayon will show the raising effect. (W)

RAYON FABRICS: FLAME-PROOFING. K. Micksch. *Kunstseide,* 1937, V. 19, P. 171–73; abs. in *J. T. I.,* Sept. 1937, P. A500.

A general article, quoting various methods especially such as give permanent effects. The use of "swollen" starch in flame-proofing compositions is mentioned. A useful solution is made by adding a concentrated solution of ammonium phosphate to aluminium sulphate until precipitation is complete and then ammonia until the liquid is clear. (C)

REMOVAL OF OILS AND FATS FROM INDUSTRIAL TEXTILES. A. Foulon. *Allgem. Oel- u. Fett-Ztg.,* 1937, V. 34, P. 310–12; abs. in *C. A.,* 1937, V. 31, Col. 7257. (W)

SHRINKAGE IN WOOL FABRICS. A. T. King. *Tex. Mfr.,* Dec. 1937, P. 513–4.

New theories in wool shrinkage and milling, and the practical implications thereof. A new method of milling is mentioned whereby milling of

woolen and lighter worsteds is actually possible without acid or alkali, giving hopes of new finishes. (C).

SIZING AND GLUEING OF WARPS. Karl Oellers. *Spinner. u. Weber,* 1937, V. 55, No. 25, P. 7–8; abs. in *C. A.,* 1937, V. 31, Col. 7655.

Directions are given for sizing and glueing with Tylose flakes. Comparative results are cited. Tylose size does not turn acid and can be stored for several days without impairment of quality. (W)

SPINNING RAYON STAPLE. R. Bruce Williams. *Tex. Wld.,* Jan. 1938, P. 72–3.

Describes a study made to compare manufacturing methods, and the results obtained therefrom, in producing a 30s yarn from 1½-denier, 1½-in. rayon staple. (C)

SUINT CLEANING METHODS FOR WOOL SCOURING. H. W. Fawcett. *Tex. Mfr.,* Dec. 1937, P. 487–8, 501.

Reduction of costs in wool scouring can be obtained by re-use of suint which has been made practicable by development of suitable high-speed centrifugals and methods of using them. (C)

SUITABLE COTTON FOR A SPECIFIED COUNT: SELECTION OF A. N. Ahmad. *Indian Text. J.,* Nov. 1937, P. 51.

Two formulae have been developed, based upon the Indian Central Cotton Committee Technological Laboratory standards of yarn strength, by which are determined the relationship between the count (C) to which a cotton may be spun and its mean fibre length (L). These are for Indian cottons ranging from 0.6 to 1-in. in staple length, and for yarn counts from 6s to 40s. The first of these formulae is $L = 0.6 + 0.009 \times C$, and is satisfactory for carefully controlled laboratory tests on small samples. An average difference of 15% between laboratory and mill results is allowed for, the formula becoming $L = 0.6 + 0.0104 \times C$. (C)

STAPLE FIBRE. F. Bonnet. *Canadian Text. J.,* Jan. 7, 1938, P. 33–6.

Paper presented to the Textile Society of Canada, Western Division, Dec. 11, 1937. Describes production technique in rayon plant, fibre characteristics, blends with cotton and wool, etc. (C)

STABILITY OF CURLING (in Textiles). O. Schmidhäuser. *Klepzig's Textil-Z.,* 1937, V. 40, P. 516–18, 527–29; abs. in *C. A.,* 1937, V. 31, Col. 8204.

A discussion of curling in cotton, wool as well as artificial textiles and a description of an app. and method of detg. the stability of curling. (W)

VELVET FABRICS: GLOSS EFFECTS. F. Knoll. *Photographie u. Forschung,* 1937, V. 2, P. 33–41; abs. in *J. T. I.,* Oct. 1937, P. A576.

Several experiments are described in which silk, rayon, and cotton velvets were folded, and illuminated from different angles, as a result of which it is shown that the gloss termed "velvety" is due to the effect of numerous bright lines lying close to each other, and which can only just be identified as such by the naked eye. This effect is due to the light reflected from the side faces of the pile. The glossy effects of panne velvet

cannot strictly be termed "velvety"; they resemble those of satin more closely. This "velvety" effect is changed in various degrees with the direction of vision and illumination. The slight reflections caused under certain illumination conditions by the surfaces of the sheared free fibre ends of the pile are not able to produce "velvety" gloss. This effect is, however, considerably dependent on the material and quality of surface of the pile; ribbon shaped and twisted pile ends (cotton) will produce a different luminous effect from that obtained with cylindrical fibres having smooth surfaces (silk and rayon). (C)

THROWSTERS' TINTS. W. F. Parry. *Tex. Wld.*, Jan. 1938, P. 58–9.

Proposes a standard method for identifying S and Z twists by color. (C)

WEIGHT OF (WARPER) ROLLER UPON THE TAKE-OFF TENSION AND A FORMULA FOR ASCERTAINING THE BEST WEIGHT: EFFECT OF. Adolph Rossie. *Mell. Textilber.*, 1937, No. 12, P. 958.

The take-off rollers used for warp beaming can never have a constant yarn tension. The weight of the group of threads, the speed of revolution, and the roller weight are the three factors that determine the relative course of the yarn tension, the first of which decreases in the ratio of its square as the bobbin decreases in thickness, the speed of revolution increases linearly, and the roller weight remains constant. It is, however, possible, by proper selection of the weight of the rollers, which remains constant, to provide for the most practical working tension. The following formula indicates how heavy the roller must be in order to ensure that the yarn tension at the end is equal to the yarn tension at the start, other conditions being equal:—

$$G = \frac{(r_2^2 - r_1^2)\,\pi\, h\, S\, r_1}{r_2 - r_1}$$

in which G = weight of roller; r_1 = radius of empty roller; r_2 = radius of full roller; h = width of yarn wound on the roller; S = specific weight of the yarn package. (C)

WOOL: STERILIZATION OF—AND EFFECT ON PHYSICAL AND CHEMICAL PROPERTIES OF A WOOL FABRIC. Harry Humfield, Ruth E. Elmquist and James H. Kettering. U. S. D. A., Technical Bulletin No. 588, Sept. 1937.

A number of sterilizing methods were tested to determine the one most satisfactory for subsequent bacteriological studies on wool fabrics using as the test organism *Bacillus mesentericus*. Physical and chemical changes in the wool fabric caused by the sterilizing treatments were measured by strength index, weight, thickness, flexural properties, sulphur and nitrogen content, methylene blue absorption, and scale breakage. Ultraviolet light, potassium permanganate, iodine, alcohols, glycerol, tribrombetanaphthol, and tetrachlorethane did not produce sterility under the experimental conditions used. Although the sodium phenylphenates prevented growth, even when present in extremely small quantities, they did not kill the organisms. Formaldehyde and mercuric salts gave sterility but were retained by the

wool and therefore rendered the fabric unfit for subsequent bacteriological studies. Intermittent steaming and dry and wet autoclaving produced sterility but changed the physical and chemical properties of the fabric to such an extent as to interfere with its use value. Heating in xylene, Stoddard solvent, or tetrachlorethylene was satisfactory from the bacteriological standpoint and in general left the fabric essentially unchanged. (C)

III. Chemical and Other Processing (Not Otherwise Classified)

Acid Dyeing of Wool: Theory of. Alfred Müller. *Klepzig's Textil-Z.*, V. 40, No. 32, P. 3; *Deut. Wollen-Gewerbe*, V. 69, P. 869; *Monatsh. Seide Kunst.*, V. 42, P. 298; *Monatschr. Textil-Ind.*, V. 52, P. 216; *Spinner u. Weber*, V. 55, No. 35, P. 20 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7653. (W)

Acid Dyeing of Wool: Contribution to the Theory of. Communication No. V. Ender and Müller. *Mell. Textilber.*, 1937, No. 12, P. 991. Communication No. 6. *Ibid.*, 1938, No. 1, P. 65.

The two authors describe the connections between molecular weight, the number of the sulpho groups, the fastness to water, speed of dyeing, and the levelling properties of wool dyestuffs. Examples are given to show that acid wool dyes that level well also dye rapidly, while those that do not dye level are much more slowly absorbed. Those dye acids that are least fast to water and consequently level best are very rapidly taken up by the fibre. On the other hand, however, no conclusion as to the levelling properties can be drawn from the speed at which they are taken up by the fibre, because that factor depends upon the affinity of the dye acid for wool, the size of the molecule, the aggregate state, and therewith also upon the speed with which the dye acid diffuses in the dyebath, and in the wool. The levelling property is mainly a function of the affinity of the dye acid for wool, that is to say, is determined by the position of the equilibrium wool + acid $\rightleftharpoons$ wool-dye-acid-compound. Consequently any change of the levelling property can be most practically effected by displacement of the equilibrium. The authors further point out the great influence exerted by the size of the molecules of the dyestuffs and the morphological structure of the wool fibre upon the speed at which acid dyes are absorbed by wool in an acid bath. The speed of absorption falls, as the molecular weight rises and the fastness to water increases, whereby the number of sulpho groups and other constitutional factors may have an important effect, the action of which on the properties of the dyeings may under circumstances overlap. The article is illustrated by a colored plate. (C)

Bleached Cotton, Rayon and Staple Fibre: Quantitative Investigations on the Varying Dyestuff Absorptivity of. Drathen, Havekost and Ruscheweyh. *Mell. Textilber.*, Nov. 1937, P. 915–18; abs. in *Silk J.*, Dec. 20, 1937, P. 27–8. (C)

Bleaching and Stripping by Sulphur Dioxide Derivatives. "Technologist." *Text. Recdr.*, Jan. 6, 1938, P. 42. (C)

CATALYTIC REDUCTION OF AZO COMPOUNDS, AND APPLICATION TO IDENTIFICATION OF DYES. W. F. Whitmore and A. Revukas. *J. Am. Chem. Soc.*, 1937, V. 59, P. 1500–3; abs. in *J. Soc. Dyers Col.*, Dec. 1937, P. 503.

Sample azo compounds may be reduced in solution to amines by hydrogen under 1–4 atm. in presence of Raney nickel catalyst at room temperature. This reaction is conveniently utilized for the identification of azo dyes. (C)

CHEMISTRY AIDS COTTONS. Walter M. Scott. *Ind. Eng. Chem., News Ed.*, 1937, V. 15, P. 297; abs. in *C. A.*, 1937, V. 31, Col. 7256.

Recent chem. treatment of cotton goods and its importance to the textile industry are discussed. (W)

COLOR-FASTNESS TO LIGHT: USE OF STANDARD DYEINGS IN TESTS FOR. W. D. Appel. *Am. Dye. Rptr.*, Jan. 10, 1938, P. 15–16. (C)

CONDUCTIVITY AND ELECTROPHETIC MOBILITY OF DIRECT DYES. B. N. Acharya, A. M. Patel and B. N. Desai. *Proc. Indian Acad. Sci.*, 1936, B. 4, P. 503–13 (through *Chem. Zentr.*, 1937, i, P. 2578); abs. in *J. T. I.*, Nov. 1937, P. A666.

The viscosity, electrophetic mobility and conductivity of Benzopurpurin 4B. Congo red, and Sky blue F.F. solutions have been measured as various concentrations, degrees of purity, and salt contents. The results point to a continual increase in particle size of the dyes on the addition of salts and the authors draw the conclusion that best results are obtained in dyeing when the salt concentration and temperature are such that the dye micelles have the dimensions of the pores in the fibre. (C)

CHLORINATION OF WOOL. Günter Rordorf. *Spinner u. Weber*, 1937, V. 55, No. 22, P. 20–1; abs. in *C. A.*, 1937, V. 31, Col. 7656.

The new chlorination method called Hypak process is based on the following principle: In addn. to alkali hypochlorites org. Cl compds. are used as buffering agents which absorb the Cl liberated on acidification and then deliver it slowly to the textile fibre; this decreases the aggressiveness of Cl. For 10 kg. wool are used 300 l. of water contg. 1.5 kg. 66° Bé. H_2SO_4. The Hypak bath is prepd. by dissolving 200 g. Hypak in 10 l. of water. The precleaned wool is placed into the H_2SO_4 bath for 10 min. and is then removed. 4 l. of Hypak soln. are added to the acid bath and the wool is immersed again for 15 min. with const. agitation. After the removal of the wool, 3 l. of Hypak soln. are added and the wool is immersed again for 15 min. The wool is removed a 3rd time, the residue of the Hypak soln. is added and the wool is immersed for a final 15-min. period. After removing the excess water the chlorinated wool is subjected to an anti-Cl bath in the usual manner. This method causes less damage to wool than other chlorination methods. (W)

CHEMISTRY OF TEXTILE ASSISTANTS: LATEST DEVELOPMENTS IN. Jackel. *Monatsh. Seide Kunstseide*, V. 42, P. 293–6; *Spinner u. Weber*, V. 55, No. 31, P. 10; *Deut. Wollen-Gewerbe*, V. 69, P. 865 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7661. (W)

CREASES IN DYED FABRICS: THEIR FORMATION AND PREVENTION. A. J. Hall. *Am. Dye. Rptr.*, Dec. 13, 1937, P. 814–15 (reprinted from *Textile Mercury and Argus*). (C)

DESENSITIZATION OF (TENDERING) ANTHRAQUINONOID DYES AND BLEACHING OF TEXTILES BY EXPOSURE TO LIGHT. E. Baur. *Helv. Chim. Acta*, 1937, V. 20, P. 879–881; abs. in *J. Soc. Dyers Col.*, Dec. 1937, P. 493. (C)

DIRECT PRINTING ON COTTON AND RAYON WITH VAT DYES, INDIGOSOLS, ETC. Carl Blau, Jr. *Deut. Wollen-Gewerbe*, 1937, V. 69, P. 931–2; abs. in *C. A.*, 1937, V. 31, Col. 7652.

A detailed description of chem. and mech. preparations. (W)

DYEING OF COTTON WITH INDIGOSOL DYES. Frische. *Deut. Wollen-Gewerbe*, 1937, V. 69, P. 998; abs. in *C. A.*, 1937, V. 31, Col. 7651.

A description of chem. and mech. treatments. (W)

DYEING: THEORY OF. E. Justin-Mueller. *Teintex*, 1937, V. 2, P. 269–75; abs. in *J. T. I.*, Sept. 1937, P. A497. (C)

FLAMEPROOFING. A SIMPLE CHEMICAL PROCESS. E. L. Johnson. *Textile Age*, Jan. 1938, P. 72–5. (C)

GLYCERINE IS USEFUL AS TEXTILE FINISHING ASSISTANT. Georgia Leffingwell. *Textile Age*, Dec. 1937, P. 66–9. (C)

HYPOCHLORITE BLEACH: EFFECTS ON COTTON. E. Elöd and F. Vogel. *Textilberichte*, 1937, V. 18, P. 64–8; abs. in *J. T. I.*, Aug. 1937, P. A438. (C)

HYPOCHLORITES OR PEROXIDES: SHOULD COTTON BE BLEACHED WITH. O. Mecheels. *Monatsh. Seide Kunst.*, V. 42, P. 298; *Klepzig's Textil-Z.*, V. 40, No. 33, P. 5; *Deut. Wollen-Gewerbe*, V. 69, P. 870 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7660.

No fundamental superiority of the peroxide-bleach method over the Cl-bleach method and vice versa can be recognized. The method to be used for a particular material should be chosen with consideration of the nature of the textile, finishing method employed, uses of the textile and the results required. In the case of the peroxide bleach it is best to raise the temp. as rapidly as possible and to add soda in order to increase the yield. During the hypochlorite bleach pH measurements must be made constantly. (W)

KIER BOIL: INVESTIGATIONS INTO THE. Leo Kollmann. *Mell. Textilber.*, 1937, No. 12, P. 994.

This article shows that the quantity of residual cotton wax is not in direct ratio to the extent of its wetting properties, as is often assumed. That is to say, a fabric that does not contain much cotton wax after treatment need not show the best wetting qualities, and a fabric with poor wetting qualities need not contain a considerable residue of cotton wax. The nature of the cotton wax residues and other impurities of raw cot-

ton are also of decisive importance. In that connection the solvent contained in the liquor is also of importance and water has been found to be more suitable than, for example, alcohol. A single boil with Cekit and two boilings under pressure (according to the limesoda process, or two lye boils) was found to produce the most extensive cleansing effect, whereby the goods had also good wetting properties and were very bright. Remarkably good results were also secured by preliminary treatment with halogens before the lye boil, and also in soap froth, both of which methods deserve more attention. The author finally points out that the Cekit boil gives good results also when applied to mixture fabrics containing cotton and staple fibre or rayon in varying proportions. (C)

MERCERIZATION OF STAPLE RAYON. Hermann Rath. *Klepzig's Textil-Z.*, 1937, V. 40, P. 519–21; abs. in *C. A.*, 1937, V. 31, Col. 7658.

Mercerization of staple rayon gives it a feel similar to that of mercerized cotton, decreases the dry and wet tensions and the strength and increases absorption of dyes. NaOH produces a greater increase in dye absorption than KOH or mixed alkalies. The luster appears to be improved, at least by KOH treatment. Mercerization produces an orientation of the crystallites in the direction of the axis of the fibre, but X-ray studies have shown smaller angles of scattering of crystallites than in unmercerized staple spun. Mercerization decreases the hygroscopicity. (W)

MERCERIZATION: SCIENTIFIC BASES OF. Kurt Hess. *Monatsh. Seide Kunst.*, V. 42, P. 297–8; *Spinner u. Weber*, V. 55, No. 28, P. 10–11; *Deut. Wollen-Gewerbe*, 1937, V. 69, P. 866; abs. in *C. A.*, 1937, V. 31, Col. 7655. (W)

METHACRYLATE RESINS: SOME NOVEL PROPERTIES OF. *Rev. gen. mat. plastiques*, April 1937, P. 115–18; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

A review is given of the methods of preparing, the properties of, and the predicted use of, various types of polymethacrylate resins. (S)

OXIDATION AND REDUCTION REACTIONS IN THE FINISHING OF TEXTILES. Karl Volz. *Spinner u. Weber*, 1937, V. 55, No. 28, P. 6–8; abs. in *C. A.*, 1937, V. 31, Col. 7655.

A review of the chem. oxidation and reduction reactions involved in bleaching, dyeing, printing and removal of dyeings. (W)

pH MEASUREMENT: MODERN VIEWS OF. G. A. Perley. *Am. Dye. Rptr.*, Dec. 27, 1937, P. 832–36.

Paper presented at meeting, New York Section, A. A. T. C. C., Nov. 19, 1937. (C)

REDUCING AGENTS IN TEXTILE PRINTING AND DYEING: TITANIUM SALTS, ZINC DUST. "Technicus." Tex. Col., Jan. 1938, P. 9–12. (C)

SOAP SOLUTIONS: INFLUENCE OF HYDROGEN ION CONCENTRATION ON ADHESIONAL WETTING BY SOAP SOLUTIONS. J. Powney and H. F. Frost. *J. T. I.*, Aug. 1937, P. T237–T254.

Measurements of the contact angle in the systems paraffin wax/air/detergent solution and wool/air/detergent solution have been carried out at

23° C. ± 2°, using buffered solutions of pure sodium laurate and sodium oleate. The angle has been shown to depend upon the surface tension of the detergent solution, and Loman and Zwikker's extension of Antonow's Law has been utilized to explain the results obtained. The spreading of soap solutions on oiled and untreated textile fibres has also been studied and the pH of the detergent solution demonstrated to have an important effect upon the placement of the oil. It is pointed out that the tendency of the detergent to spread over the substrate is as important a factor as its tendency to spread over the oil. (C)

SOAP VS. NEW TEXTILE ASSISTANTS. F. G. Brown. *Tex. Mfr.*, Dec. 1937., P. 511–12; Jan. 1938, P. 34–5.

A review of the many new textile chemicals on the basis of chemistry, properties, and use compared with soap. (C)

STAPLE FIBRE: DYEING. H. Brandenburger. *Textilberichte*, 1937, V. 18, P. 649–51; abs. in *J. T. I.*, Nov. 1937, P. A620.

The dyeing of staple fibre and staple fibre-wool mixtures is discussed and it is pointed out that in order to obtain fast dyeings of the latter the staple fibre should preferably be dyed first in the form of loose fibre or combed sliver. Staple fibre dyed in the spinning process may also be used. Difficulties encountered in dyeing loose staple fibre and combed slivers with substantive cotton dyes, naphthol, sulphur and vat dyes are discussed, some general precautions are described, and procedures for the application of substantive and sulphur dyes are outlined. (C)

SUBSTANTIVE DYEING OF RAYONS (PHENOMENA OCCURRING DURING). W. Weltzien. *Monatsh. Seide Kunst.*, V. 42, P. 298–9; *Deut. Wollen-Gewerbe*, V. 69, P. 870; *Klepzig's Textil-Z.*, V. 40, No. 33, P. 5; *Monatschr. Textil-Ind.*, V. 52, P. 216; *Spinner u. Weber*, V. 55, No. 35, P. 20 (1937); abs. in *C. A.*, 1937, V. 31, Col. 3702, 7652.

Substantive dyes are colloidal electrolytes which in electrolyte-free aq. soln. have high diffusion powers but do not dye rayon, probably because of elec. potential differences within the soln. The addn. of electrolytes neutralizes the soln., increases the state of aggregation and renders the dye particles substantive. During const. dyeing conditions a state of satn. occurs after periods of time which differ greatly with the various dyes and textile fibres. The addn. of salt and lowering of temp. increases the aggregation and amt. absorbed during equil. and decreases the velocity of absorption. This occurs with uniform absorption of the dye on the fibre. The assumption that the uniform distribution is facilitated by a very low degree of dispersion of the dye and that a similar condition holds true for the penetration of the dye is incorrect. It is characteristic that all the leveling agents used are capillary active and appreciably lower the surface tension. The addn. of electrolytes as well as the presence of substantive dyes which are sulfonic acid salts also lowers the surface tension. It is essential for the proper progress of substantive dyeing that the substantivity is not too great as an increase in substantivity hastens the pptn. of the dye and thus renders its distribution over the surface of the fibre very irregular. In most cases a parallelism was found between substantivity and velocity of absorption. (W)

THIOCYANATE PROCESS FOR WOOL CRÊPE AND EMBOSS-EFFECTS (IMITATION CHASING). Ed. Justin-Mueller. *Mell. Textilber.*, 1937, V. 18, P. 628–29; abs. in *C. A.*, 1937, V. 31, Col. 7656. (W)

IV. RESEARCH METHODS AND APPARATUS

"PRALKA" FASTNESS-TO-WASHING TESTING APPARATUS. W. Kaczkowski. *Textilberichte*, 1937, V. 18, P. 637–8; abs. in *J. T. I.*, Nov. 1937, P. A643.

The "Pralka" apparatus for testing the fastness of dyeings to washing, water and perspiration, as recommended by the Polish standardization commission, comprises a cylindrical vessel provided with a perforated cover and with a thermometer and an outflow tube. Through the centre of the cover passes a shaft carrying two bakelite rings which can be moved up and down at a rate of 60 times a minute in the cylindrical vessel. The latter is surrounded by a water bath. A circular sample of the dyed fabric to be tested is placed between two discs of white fabric and the three layers are held between the two bakelite rings which are pressed together by means of screws. In order to test for fastness to washing, a soap and soda solution is placed in the cylinder and tests are made at different temperatures. After 15 minutes treatment with the liquid the sample is removed and classified according to the transfer of color to the white samples. These may be of cotton, wool, rayon, silk or linen and in the results it is necessary to state the type against which the tests are made. For testing the fastness to water, the cylinder is filled with distilled water and the effects of treatment for 10 minutes and for one hour are detd. Fastness to perspiration is determined by means of a solution of ammonia and salt which is acidified with acetic acid after a certain period of treatment. (C)

SERICIN: DETECTION WITH PHTHALDEHYDE. H. Kaneko. *Bull. Sericult Silk Ind. Japan*, 1937, V. 9, P. 113–4 (through *Chem. Zentr.*, 1937, i, P. 3895; abs. in *J. T. I.*, Nov. 1937, P. A640.

Sericin gives with *o*-phthaladehyde a characteristic violet color that may be used to detect sericin in degummed silk. The reaction is not shown by silk that has lost 25% of its weight in degumming. Fibroin A and B obtained by fractional precipitation with ammonium sulphate give a violet, and a scarlet color, respectively. The scarlet color of fibroin gives place to a violet color when the silk is boiled for some time with dilute alkalis. On prolonged boiling with alkali, fibroin almost completely dissolves, the solution containing pepetone and polypeptides. The dispersed fibroin in the solution is precipitated by the addition of acids or neutral salts; it gives the scarlet color of fibroin B with *o*-phthaladehyde. (C)

STAPLE FIBRES: SURFACE STRUCTURE. R–O–X EMBEDDING MEDIUM: APPLICATION. Reumuth, Kling and Schwerdtner. *Kunstseide*, 1937, V. 19, P. 247–60; abs. in *J. T. I.*, Nov. 1937, P. A638.

In the R–O–X embedding process, 12 to 15 fibres are stretched across and attached to a rectangular frame made from glass strips which is designed to fit round an ordinary microscope slide. The slide is coated with an R–O–X reagent which after evaporation of the solvent gives an embedding agent having a refractive index as near as possible to that of the

fibre. R–O–X reagents of different refractive indices suitable for use with the different fibres are available. The thickness of the coating is such that the fibres are only half immersed in it. After drying, the fibres are cut along the edges of the slide and the latter carrying lengths of fibre embedded in R–O–X up to half their thickness is transferred to the microscope and observed by transmitted light. In this way it is possible to observe details of the surface structure and obtain photographs in which effects to the back half of the fibre are eliminated. Details of the microscope and photographic arrangements are briefly described. Photo-micrographs (× 540) of various staple fibres, including Cuprama, Vistra, Lanusa, Schwarza, Rhodia-Albene, Dravinella Artilana, Lanital, Glanz-Courto, Flox, Sniafocco, etc., are shown and compared with those of wool and cotton. Photomicrographs of cross-sections of the fibres are also given and the use of R–O–X as an embedding agent in the preparation of cross-sections is described. (C)

V. Economics, Physics and Miscellany

Benzylcellulose: Studies on the. H. Saegusa and Y. Nakayama. *J. Chem. Ind., Japan*, Feb. 1937, P. 63B–64B; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

The effect of the concentration of caustic soda solution for steeping cellulose, the benzylating temperature, the amount of benzyl chloride, and the addition of some other chemicals to the reaction mixture upon the properties of the benzylated product are briefly reported. (S)

Polymerides: Formation. E. Dreher. *Kunststoffe*, 1937, V. 27, P. 137–42, 221–28; abs. in *J. T. I.*, Nov. 1937, P. A663.

A review of polymerization phenomena. (C)

Production Costs: Economic Limit to Rationalization. R. Boye. *Leipz. Monats. Tex. Ind.*, 1937, V. 52, P. 163–4; abs. in *J. T. I.*, Nov. 1937, P. A671.

The cost "valency" (ratio of variable to fixed costs) of an industrial concern is discussed and it is pointed out that a low value of the cost valency indicates high fixed costs and reduced power of an undertaking for adaptation to varying market conditions. By means of this conception of cost valency it is possible to determine the permissible rise in fixed costs for a given fall in variable costs, and vice versa, for a given production and the same total costs. Various cases are studied and it is shown that with increase in the fixed cost component there is a progressive narrowing of the economic rationalization possibilities. (C)

Research and Testing. Erwin J. Saxl. *Tex. Wld.*, Jan. 1938, P. 63.

The author presents facts and figures proving that through the improvement of quality in textile materials and reduction of costs by the use of modern testing instruments, research has not only paid for itself, but it has made possible better profits in the textile industry—and we have just started. (C)

STARCH: HYDROLYSIS. A. Tychowski and S. Mesior. *Biochem. Z.*, 1937, No. 292, P. 141–47, 218–20; abs. in *J. T. I.*, Nov. 1937, P. A663. (C)

SYNTHETIC RESINS: PHYSICAL TESTING. R. Vieweg. *Kunststoffe*, 1937, V. 27, P. 213–6; abs. in *J. T. I.*, Nov. 1937, P. A667.

Refractive index and thermal conductivity are recommended as characteristics of plastics. As refractive index depends on temperature, the refractometer should be furnished with an ultra-thermostat. Data are recorded for several products. Indirectly, heat conductivity, λ, can be calculated from the temperature conductivity, a, measured by Steger's apparatus, the specific heat, c, measured by Bunsen's condensation calorimeter with special arrangements for artificial materials and the specific gravity ρ by the equation $\lambda = a\rho c$. The technique of these measurements is described and specific heats are tabulated. (C)

ULTRACENTRIFUGE AND THE STUDY OF HIGH MOLECULAR COMPOUNDS. T. Svedberg. *Nature*, June 19, 1937, P. 1051–62; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

The oil-turbine ultracentrifuge is described and the results obtained with it in a study of proteins are given. Molecular constants, *e.g.*, sedimentation weight, are tabulated for a large number of proteins. (S)

VISCOSITY MEASUREMENTS ON AMINO ACIDS: CONCERNING HIGHLY POLYMERIZED COMPOUNDS. H. Staudinger and H. Becker. *Ber. deut. chem. Ges.*, 1937, V. 70, No. 5, P. 889–900; abs. in *Eastman Kodak Abs. Bull.*, Sept. 1937.

Viscosity measurements are reported for a number of acylated amino acids and their esters and for esters of acylated dipeptides in benzene, carbon tetrachloride, chloroform, and pyridine. Measurements were made on 1.4% solutions at 20° and 60° C. The results show that the same relation between specific viscosity ($n_{sp} = n \cdot y$, where n is the number of chain increments, and y is a constant characteristic of the solvent) and chain length, which is applicable to purely homopolar (hydrocarbon) compounds, is not applicable to acylated amino acids and their esters and dipeptides. Instead, the viscosities found are higher by an approximately constant increment than those calculated by the above equation. The authors believe that this is due to the dipolar character of the CO–NH linkage, since the increment is approximately doubled for the dipeptides. A further discrepancy is found in pyridine solutions which is said to be due to formation of pyridinium salts with the compounds. These effects make it difficult to use viscosity determinations for calculating chain lengths in albuminous proteins. (S)

ELECTROPHORESIS: THEORY. S. R. Craxford, O. Gatty and H. A. C. McKay. *Phil. Mag.*, 1937, V. 23, P. 1079–82; abs. in *J. T. I.*, Oct. 1937, P. A585.

It is shown that for electrically conducting particles, when the interphase between the two phases is completely polarizable and when the potential gradient causing electrophoresis is very small, the electrophoretic force, F, on a particle is $Q \cdot \triangle V / \triangle x$, where $V / \triangle x$ is the electrical potential gradient causing electrophoresis and Q is the net charge on the particle as

measured by electrocapillary or other methods. This result can be deduced rigorously by means of an isothermal cycle, an outline of which is given. (C)

GELATIN GEL: EFFECT OF pH ON PROPERTIES. J. H. C. Merckel. *Kolloid Z.*, 1937, V. 78, P. 339–41; abs. in *J. T. I.*, Aug. 1937, P. A461. (C)

GELATIN SOLS: STRUCTURE-VISCOSITY. W. Ostwald and W. S. Stuart. *Kolloid Z.*, 1937, V. 78, P. 324–38; abs. in *J. T. I.*, Aug. 1937, P. A461. (C)

INTERFACIAL TENSION MEASUREMENTS: INFLUENCE OF SUPERFICIAL IMPURITIES. E. Vellinger and A. Gregoire. *Bull. Soc. Chim.*, France, 1937, (V), V. 4, P. 716–17; abs. in *J. T. I.*, Aug. 1937, P. A461. (C)

MICROBIOLOGY OF TEXTILES. L. D. Galloway. *Tex. Recdr.*, Sept. 6, 1937, P. 32–4.

The dangers and uses of bacteriological growths in textile processes. (C)

Book Reviews

A. S. T. M. STANDARDS ON TEXTILE MATERIALS. (Prepared by Committee D–13 on Textile Materials.) American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price $2.00.

This 1937 edition of this annual volume contains the 44 standards established by Committee D–13 as of September, 1937, including specifications, tolerances, methods of testing, together with definitions and terms. Those of general application are listed first, followed by those relating respectfully to cotton, rayon, wool, asbestos and miscellaneous textiles. In addition to these standards the volume contains a large number of photomicrographs of common textile fibres; yarn-number conversion tables; a psychrometric table of relative humidity; a proposed method of correction of breaking strength to standard regain; a list of papers relating to textile materials appearing in the proceedings of the society; abstracts of papers presented before Committee D–13 during the last year; a list of members and of the personnel of the various sub-committees. (C)

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS 1937 YEAR BOOK. Howes Publishing Co., Inc., 440 Fourth Ave., New York, N. Y. Pp. 646. Price, $3.00.

This standard reference book for the textile chemist and colorist has been thoroughly revised and brought up to date of its publication—September, 1937. For reference purposes the sections devoted to the following subjects are of major value: Standard methods for testing dyes and chemicals; a classified list of all dyestuffs made in this country, and a similar list of textile chemical specialties; a bibliography of books and papers on textile chemistry and allied subjects. The activities Association's Research Associates for the preceding year are reporte

considerable detail by the Research Committee and its sub-committees. There are also the usual sections devoted to other organization details, and to alphabetical and geographical lists of members, the total membership now exceeding 2,000. (C)

HANDBOOK OF SCIENTIFIC AND TECHNICAL SOCIETIES AND INSTITUTIONS OF THE UNITED STATES AND CANADA. National Research Council, 2101 Constitution Ave., Washington, D. C. Pp. 283. Price, $3.00 in paper cover; $3.50 in cloth.

This is the third edition, published in October, 1937; previous editions were published in 1927 and 1930. (C)

SELECTED LIST OF REFERENCES ON THE CHEMICAL TESTING OF TEXTILE MATERIALS. American Home Economics Association, Mills Bldg., Washington, D. C. Pp. 30. Price, 40c.

Prepared by the committee on textile analysis of the textiles and clothing division of the A. H. E. A., as a part of its program to make available to instructors and students interested in textile research directions for acceptable procedures in textile analysis. Includes titles and abstracts of books and articles in English, German and French from 1920 to 1937. The arrangement and coverage are highly commendable, excepting for an occasional reference to articles in publications long out of business and print; *Posselt's Textile J.* being an example. (C)

TEXTILE TESTING. James Lomax, F.I.C. Longmans-Green & Co., 114 Fifth Ave., New York, N. Y. Pp. 176. Price, $3.00.

The author, who describes himself as "a lecturer and external examiner in textile testing," states that his objective was a text book covering the elements of the subject that would be a useful guide for students, factory testers and others engaged in the textile trade. Unquestionably he has produced a useful, elementary treatise on physical and chemical testing methods as commonly practised in English textile mills and schools. Excepting for certain textile terms and data that are peculiarly English the book will be found generally useful. It is unfortunate, however, that the author's treatment of such subjects as sampling and statistical analysis is so elementary as to give the student little idea of their basic importance and possibilities. Here and throughout the book a useful service could have been provided by inclusion of a bibliography of articles covering basic principles and additional techniques. Many textile tests, and their apparatus and techniques, that are commonly employed in this country are not mentioned. In these various respects the book has performed a useful service in indicating what should be the coverage of a more scientifically comprehensive work. (C)